Every CFL is decidable

$A_{CFG} = \{ \langle G, w \rangle \mid G$ is a CFG that generates $w \}$

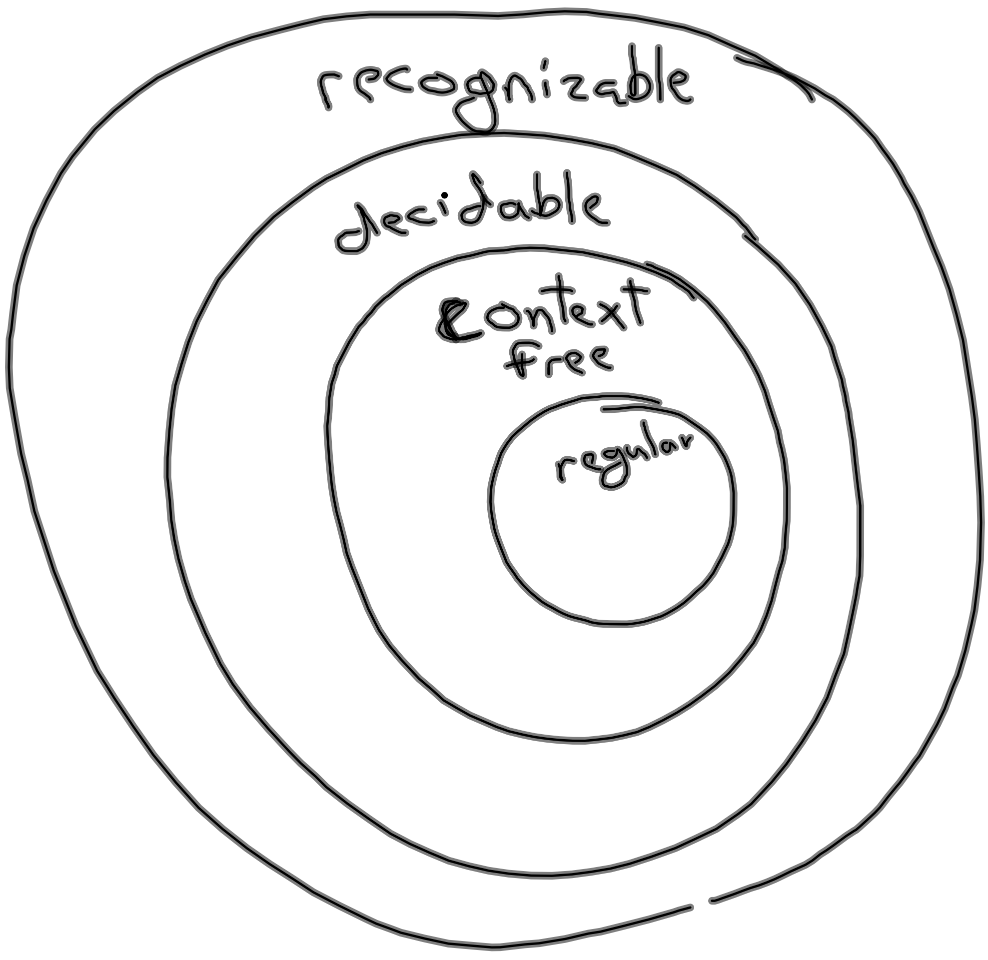
↳ construct TM, S

TM M_G: G is a CFG for L

L is a CFL

on input w

1. Run TM S on input $\langle G, w \rangle$
2. If S accepts, accept. Otherwise reject.


recognizable
decidable
context free
regular

$A_{TM} = \{ \langle M, w \rangle \mid M$ is a TM that accepts $w \}$

A_{TM} is not decidable

A_{TM} is recognizable by TM U

U = on input $\langle M, w \rangle$

1. simulate M on w
2. if M enters an accept state, accept.
   if M enters a reject state, reject.

Halting problem: does a TM halt (accept or reject) on a given input?

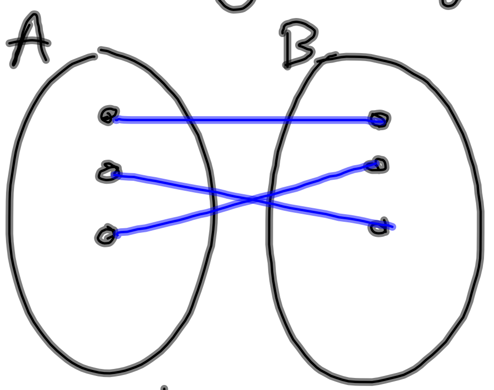
U: universal T.M.

sets: A, B

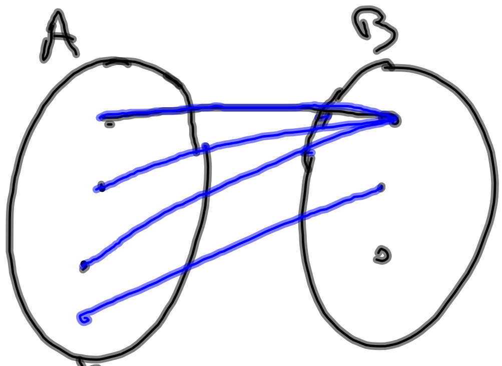
function: $f: A \to B$

f is one-to-one:

if $f(a) = f(b)$ then $c = b$



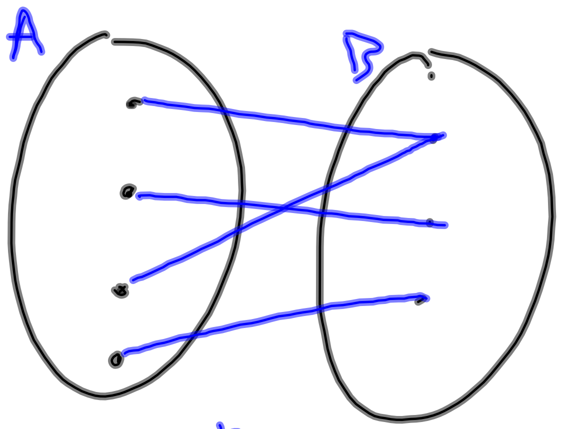
one to one



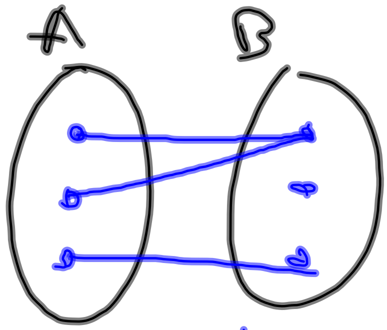
not one to one

if $a \neq b$ then $f(a) \neq f(b)$

f is onto: every item in B is mapped to



onto



not onto

$$\forall b \in B \; \exists a \in A \text{ s.t. } f(a) = b$$

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correspondence $\Longrightarrow$ one-to-one
bijection and onto